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MODERATOR MAIRE: I am Dick Maire, from the Agricultural Extension Service, Los Angeles County, California, and am working with nursery production problems. I am very happy to be here to moderate the second session this morning. We are going to consider the subject of container production of nursery stock and we have a very fine group of speakers. To open, we have Dr. James Kelley. He is from the University of Kentucky where he has been doing work in ornamental research, as well as teaching, for the last ten years or so. He has done quite a bit of work with container production problems and is going to bring us up to date on some of his new ideas in container production of nursery material. The more we can learn about techniques in this field the better. Dr. Kelley:

CONTAINER PRODUCTION OF NURSERY STOCK

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The expanding use of containers for the production of nursery stock has created a need for more information regarding the production of woody plants by this method. Twenty years ago the growing of a plant in a restricted volume of soil was foreign to many nurserymen and many questions were unanswered concerning the cultural practices involved. Today we have a number of answers but still many questions remain to be answered.

Some of the biggest problems have been concerned with fertilization, growing medium, and winter protection. These are some of the items I would like to comment on today and hope that the results of our studies over the past few years may be of value to you in solving some of your production problems associated with growing nursery stock in containers.

Fertilization — Fertilization appears to be one of the least understood factors in growing plants in containers. The purpose of fertilization is to provide an optimum supply of nutrients in order for plants of that particular species to make maximum growth. Many times the desire for maximum growth leads to application of excessive amounts of fertilizer which can be as detrimental to growth as is a lack of fertilization.

Water soluble fertilizers are most commonly used for container-grown stock. However the development of various sources of slow-release nitrogen have been of great value, particularly to the nurseryman with a limited number of container-grown plants.

Urea-formaldehyde was the first synthetic slow-release source of nitrogen. Since then several slow-release nitrogen sources have been developed, among them being ferrous-ammonium-phosphate, magnesium-ammonium-phosphate, and resin-coated fertilizers.

Among the plants we have used to evaluate the various sources and forms of nitrogen are: *Euonymus alata* 'Compacta', *Euonymus fortunei* 'Vegeta', *Azalea* 'Hino-Crimson', *Pyracantha coccinea* 'Lalandei', *Ilex crenata* 'Latifolia', *I.c.* 'Helleri', and *Prunus laurocerasus* 'Schipkaensis'. Generally one application of a slow-release nitrogen source will supply nitrogen for 3 or 4 months. Otherwise maximum growth can be obtained by frequent applications of water soluble fertilizers.

Soil mixes — We have tried soil mixes containing one-third each of soil, sand and peat; one-half each of sand and peat, and one-half each of peat and perlite. All mixes must receive applications of phosphorus, calcium and magnesium as well as nitrogen and potassium.

Good plants can be grown in all these materials. The factors to be considered in selecting a mix are: cost of materials, ease of handling, weight of finished plants (if shipped), and willingness of the operator to adapt to the requirements of a given mix, such as changes in watering, fertilizing and overwintering practices.

Winter protection — Generally speaking some winter protection must be given container-grown nursery stock in areas where sub-freezing temperatures occur. The minimum protection is to place the containers can to can. This, however, is not satisfactory in most cases except for the hardiest of plants. We have found, as have others, that some type of plastic-covered structure gives the best protection for most plants.

We have used quonset-hut type plastic structures for a number of winters. These are supported by steel rods covered with fence wire, with a 4-mil layer of plastic over this. Early in our work, we felt that during warm winter days, ventilation was advantageous in order to reduce temperatures, since some days the temperature would run as high as 90°F within the structure. However, after a few years, it was easily seen that ventilation was detrimental to plant hardiness. This was attributed to the drop in relative humidity in the house. For example, once the structure is ventilated, moisture moves out of the house and then plants start to transpire rather rapidly even though the soil mix in the can is frozen and the roots are unable to absorb moisture. The result is burning and leaf damage to broad-leaved evergreens. We have found that the best method, under our conditions, is to keep the house as completely sealed as possible and—regardless of the temperature during the winter months—not to ventilate. In work with Japanese holly in regard to winter protection, it was found that plants on the outside rows or the perimeter rows in a bed are most subject to winter injury and were always the first to be injured or killed by low temperatures. It is particularly important that plants be placed can to can for maximum protection. Recent work in Virginia and Pennsylvania have shown the advantage of placing water within the overwintering structure. In Pennsylvania, after the houses were constructed for the winter, a plastic ditch was made in the aisle and filled with water. In Virginia, a much simpler method of using water to reduce injury in overwintering was to place two 55-gallon drums of water in each house. When temperatures within the structure reached 32°F the water freezes and heat is released. When ice thaws, considerable heat is required thus tending to produce a moderation of temperature in the house during the winter. In Virginia, houses were found to be between 5° and 10°F warmer when water was in the house.

Japanese yew in houses containing 100 gallons of water made approximately twice the shoot growth the following spring as plants that were overwintered in houses not containing water. Other plants produced a similar response when stored in houses containing water in 55-gallon barrels. Approximately 100 gallons of water/200 sq. ft. was found to be satisfactory in most cases.

In conclusion, I would like to say that our findings show that slow—release sources of nitrogen will supply nitrogen for a three to four month period and result in growth equal to that of plants receiving water soluble materials. Soil mixes should be considered from the standpoint of economy, since cultural practices can be modified in order to grow a good plant in most mixes. Winter protection should be in an airtight structure in order to maintain a high relative humidity and, in the case of broad-leaved evergreens, some shading is desirable in order to reduce temperature fluctuations and transpiration.

MODERATOR MAIRE: Our next speaker, Mr. John Massot, is going to talk about quality in container production. He has been a nurseryman most of his life and was raised in the nursery business in France. He has been in Canada quite a number of years, doing a good job of liner and general production in 1, 2, and 5-gallon cans. His nursery is in Richmond, B.C., only a couple of miles from here. John, will you come up now and tell us about quality in container production.